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Family-Group Names for Termites (Isoptera)

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ABSTRACT

Thirty-nine available family-group names are identified within the insect order Isoptera (termites). For all names the correct author, date, type genus, and combining stem are provided for the first time. This nomenclatural compilation is done to stabilize the usage of family-group names in the Isoptera in advance of a world catalog. Several problems of priority are identified and discussed. The little understood subfamily Foraminitermitinae is diagnosed; while generally believed by many authors to be a new, unnamed subfamily, it was in fact established by Holmgren nearly a century ago. The subfamilies **Syntermitinae** and **Sphaerotermitinae** are newly proposed for the mandibulate genera of nasute termites and for *Sphaerotermes*, respectively. The classification of Isoptera is briefly outlined.

INTRODUCTION

It has long been recognized that the current usage of family-group names in the classification of termites (Isoptera) is not fully in accord with the rules of zoological nomenclature (ICZN, 1999). Not only has the authorship and date of many names been incorrectly stated (e.g., by Snyder, 1949) and the Principle of Coordination (ICZN, 1999: Art. 36) ignored, but in many instances more critical issues of priority have not been followed, thereby jeopardizing the stability of termite classification. In fact, the numerous errors that appear in Snyder's (1949) catalog have been perpetuated by subsequent authors, who, rather than checking the original literature and applying the rules of nomenclature, have lifted from Snyder or from other catalogs which were in turn derived from Snyder (e.g., Roonwal and Chhotani, 1989; Chhotani, 1997).

In our preparation of a revised catalog of

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the world termite fauna (Krishna and Engel, in prep.), we have gone to great lengths to attend to these nomenclatural difficulties (e.g., Engel and Krishna, 2001a, 2001b, in press a & b; Engel et al., 2003). In order to bring the usage of family-group names into accord with ICZN (1999) rules, we provide herein a catalog of all such names that have been applied in the Isoptera. This has been done to correct the various circulating errors, to highlight the most egregious problems, and to lay a standardized foundation for the forthcoming catalog. In addition, we have provided systematic descriptions for three subfamilies (two new), which are otherwise not employed by isopterists today but must be validated prior to the publication of the catalog (Krishna and Engel, in prep.). We have also included those published names that are otherwise unavailable at the end of the listing of available names. It must be noted that additional unavailable names have been used on internet sites and employed by GenBank, but none of these have met the criteria of valid publication. While being unavailable, like the three Holmgren names considered below, these names have not been published in the sense defined by the ICZN (1999) (unlike Holmgren's names which were published in accordance with the ICZN) and are therefore excluded from this study.

TAXONOMIC CATALOG

Below we list in order of priority all family-group names proposed for termites. The names are presented in their original forms, regardless of present day rank or suffix. The type genus is provided along with the correct combining stem for composing a family-group name. Daggers (†) indicate names proposed for fossil taxa. Some names were believed to have been *nomina nuda* by Snyder (1949) when they were first proposed; however, prior to 1931 family-group names could be made available by simple formation from an available genus-group name (ICZN, 1999: Art. 12.2.4) and need not have had a formal description.

Available Names

1. Termitina Latreille, 1802: 293. Type genus: *Termes* Linnaeus, 1758. Combining stem: Termit–. Note: Latreille (1805, 1810) subsequently changed the name of his "famille" to Termitinae but the name was made available in 1802 (ICZN, 1999: Art. 11.7).

2. Calotermitinae Froggatt, 1897: 516. Type genus: *Kalotermes* Hagen, 1853 [*Calotermes* Hagen, 1858 is an unjustified emendation: see Engel and Krishna, 2001a; ICZN, 2002]. Name emended to Kalotermitinae Froggatt, 1897, in accordance with ICZN (1999: Art. 29.1). Combining stem: Kalotermit–.

3. Glyptotermitinae Froggatt, 1897: 518. Type genus: *Glyptotermes* Froggatt, 1897. Combining stem: Glyptotermit–.

4. Rhinotermitinae Froggatt, 1897: 518. Type genus: *Rhinotermes* Hagen, 1858. Combining stem: Rhinotermit–.

5. Heterotermitinae Froggatt, 1897: 550. Type genus: *Heterotermes* Froggatt, 1897. Combining stem: Heterotermit–.

6. Mastotermitinae Desneux, 1904a: 284. Type genus: *Mastotermes* Froggatt, 1897. Combining stem: Mastotermit–.

7. Hodotermitini Desneux, 1904a: 284. Type genus: *Hodotermes* Hagen, 1853. Combining stem: Hodotermit–.

8. Stolotermitinae Holmgren, 1910a: 285. Type genus: *Stolotermes* Hagen, 1858. Combining stem: Stolotermit–. Note: This name unfortunately has priority over Termopsidae Holmgren, 1911, a fact discovered too late to be included in the petition to conserve *Termopsis* and Termopsidae relative to Mastotermitidae (Engel et al., 2003). Therefore, a second petition was prepared to the ICZN to conserve Termopsidae relative to Stolotermitidae (Engel and Krishna, in press a), since it would be destabilizing for nomenclature to use Stolotermitidae in place of what is today referred to as Termopsidae.

9. Leucotermitinae Holmgren, 1910a: 285. Type genus: *Leucotermes* Silvestri, 1901. Combining stem: Leucotermit–.

10. Coptotermitinae Holmgren, 1910a: 285. Type genus: *Coptotermes* Wasmann, 1896. Combining stem: Coptotermit–. Note: Proposed again as new in Holmgren (1910b).

11. Serritermitinae Holmgren, 1910a: 285. Type genus: *Serritermes* Wasmann, 1897. Combining stem: Serritermit–.

12. Termitogetoninae Holmgren, 1910a:

286. Type genus: *Termitogeton* Desneux, 1904b. Combining stem: Termitogeton–.

13. Microcerotermitinae Holmgren, 1910b: 145. Type genus: *Microcerotermes* Silvestri, 1901. Combining stem: Microcerotermit–.

14. Eutermitinae Holmgren, 1910b: 146. Type genus: *Eutermes* Heer, 1849. Combining stem: Eutermit–. Note: This name has priority over Nasutitermitinae, despite the synonymy of its type genus with *Nasutitermes* (ICZN, 1999: Art. 40.1). *Eutermes* should also take precedence over *Nasutitermes*, compounding the confusion. Use of Eutermitinae in place of Nasutitermitinae, however, would be destabilizing for termite nomenclature. A petition to the ICZN has been prepared to conserve *Nasutitermes* and Nasutitermitinae (Engel and Krishna, in press b). Current usage should be maintained until an authoritative decision is rendered.

15. Termopsinae Holmgren, 1911: 35. Type genus: *Termopsis* Heer, 1849. Combining stem: Termops–. Note: See comments on Stolotermitinae (above).

16. Psammotermitinae Holmgren, 1911: 64. Type genus: *Psammotermes* Desneux, 1902. Combining stem: Psammotermit–.

17. Pseudomicrotermitinae Holmgren, 1912: 5. Type genus: *Pseudomicrotermes* Holmgren, 1912. Combining stem: Pseudomicrotermit–.

18. Foraminitermitinae Holmgren, 1912: 5. Type genus: *Foraminitermes* Holmgren, 1912. Combining stem: Foraminitermit–.

19. Stylotermitinae Holmgren and Holmgren, 1917: 141. Type genus: *Stylotermes* Holmgren and Holmgren, 1917. Combining stem: Stylotermit–.

20. Arrhinotermitinae Sjöstedt, 1926: 8. Type genus: *Arrhinotermes* Wasmann, 1902. Combining stem: Arrhinotermit–.

21. Acanthotermitinae Sjöstedt, 1926: 8. Type genus: *Acanthotermes* Sjöstedt, 1900. Combining stem: Acanthotermit–. Note: This name has priority over Macrotermitinae; however, a petition has been submitted to conserve the usage of Macrotermitinae (Engel and Krishna, 2001b), which has been approved by the ICZN (2003). Macrotermitinae is to be used whenever *Macrotermes* and *Acanthotermes* are placed into the same family-group taxon.

22. Macrotermitinae Kemner, 1934: 69. Type genus: *Macrotermes* Holmgren, 1909. Combining stem: Macrotermit–. Note: See comments for Acanthotermitinae (above).

23. Amitermitinae Kemner, 1934: 110. Type genus: *Amitermes* Silvestri, 1901. Combining stem: Amitermit–.

24. Miro-capritermitinae Kemner, 1934: 166. Type genus: *Mirocapritermes* Holmgren, 1914. Combining stem: Mirocapritermit–. Note: Although Kemner (1934) hyphenated the name in its original spelling, the ICZN (1999) does not allow hyphenation and the family-group name must be considered a single word.

25. Nasutitermitinae Hare, 1937. Type genus: *Nasutitermes* Dudley, 1890. Combining stem: Nasutitermit–. Note: See comments above on Eutermitinae.

26. †Electrotermitinae Emerson, 1942: 10. Type genus: †*Electrotermes* Rosen, 1913. Combining stem: Electrotermit–.

27. Porotermitinae Emerson, 1942: 10. Type genus: *Porotermes* Hagen, 1858. Combining stem: Porotermit–.

28. Apicotermitinae Grassé and Noirot, 1954 [1955]: 360. Type genus: *Apicotermes* Holmgren, 1912. Combining stem: Apicotermit–.

29. Cubitermitini Weidner, 1956: 99. Type genus: *Cubitermes* Wasmann, 1906. Combining stem: Cubitermit–.

30. Mirotermitini Weidner, 1956: 99. Type genus: *Mirotermes* Wasmann, 1897. Combining stem: Mirotermit–.

31. Capritermitini Weidner, 1956: 100. Type genus: *Capritermes* Wasmann, 1897. Combining stem: Capritermit–.

32. Indotermitidae Roonwal and Sen-Sarma *In* Roonwal, 1958: 81. Type genus: *Indotermes* Roonwal and Sen-Sarma *In* Roonwal, 1958. Stem: Indotermit–.

33. †Cretatermitinae Emerson, 1968: 278. Type genus: †*Cretatermes* Emerson, 1968. Combining stem: Cretatermit–.

34. Prorhinotermitinae Quennedey and Deligne, 1975: 265. Type genus: *Prorhinotermes* Silvestri, 1909. Combining stem: Prorhinotermit–.

35. †Lutetiatermitinae Schlüter, 1989: 61. Type genus: †*Lutetiatermes* Schlüter, 1989. Combining stem: Lutetiatermit–.

36. †Carinatermitinae Krishna and Gri-

maldi, 2000: 134. Type genus: †*Carinatermes* Krishna and Grimaldi, 2000. Combining stem: Carinatermit–.

37. †Archeorhinotermitinae Krishna and Grimaldi, 2003: 2. Type genus: †*Archeorhinotermes* Krishna and Grimaldi, 2003. Combining stem: Archeorhinotermit–.

38. Syntermitinae Engel and Krishna, herein (see below). Type genus: *Syntermes* Holmgren, 1909. Combining stem: Syntermit–.

39. Sphaerotermitinae Engel and Krishna, herein (see below). Type genus: *Sphaerotermes* Holmgren, 1912. Combining stem: Sphaerotermit–.

Unavailable Names

Some authors (e.g., Banks, 1920; Roonwal and Chhotani, 1989) have erroneously equated the following three names with some of the present families or subfamilies. All three are unavailable and therefore do not enter into zoological nomenclature and should not be used.

1. Metatermitidae Holmgren, 1909: 99. Unavailable, as it was not based on an available genus-group name (ICZN, 1999: Art. 11.7.1.1).

2. Mesotermitidae Holmgren, 1909: 100. Unavailable, as it did not include *Mesotermes* Haase, 1890 (ICZN, 1999: Art. 11.7.1.1) and was therefore not based on a genus-group name. Note: This name was proposed as new again in Holmgren (1910a) and Holmgren (1910b). [*Mesotermes* was an available genus-group name at that time, but recognized by Handlirsch (1906) as a neuropteran and not a termite. Holmgren (1909, 1910a) clearly did not intend this name to be based on the fossil neuropteran *Mesotermes* but established it instead for a series of explicitly included, living termite genera (see Holmgren, 1910a, 1910b), which he believed to occupy an intermediate phylogenetic position in his scheme of termite relationships; thus, *Mesotermes* was not included by inference of the generic stem of Mesotermitidae (ICZN, 1999: Art. 11.7.1.1) and the name was never made available.]

3. Protermitidae Holmgren, 1909: 100. Unavailable, as it was not based on an available genus-group name (ICZN, 1999: Art. 11.7.1.1). Note: This name was proposed as new again in Holmgren (1910a) and Holmgren (1910b). [A genus-group name, *Protermes*, was not proposed until 1910, at which time Holmgren (1910a) did not include *Protermes* in his Protermitidae, placing it instead in Metatermitidae (in fact, *Protermes* was never included in Protermitidae). Protermitidae was used exclusively for what Holmgren considered to be the basal termites. Thus, Protermitidae was not subsequently validated in the later publications of Holmgren.]

SYSTEMATIC DESCRIPTIONS

Below we provide descriptions for three little understood subfamilies of Termitidae, one hitherto little understood and two new. The Foraminitermitinae was originally proposed by Holmgren (1912) but has not been generally recognized. The genera *Foraminitermes* and *Labritermes*, however, have increasingly been recognized as distinctive and worthy of exclusion from Termitinae (e.g., Krishna, 1963; Noirot, 2001; Bitsch and Noirot, 2002), where they had been placed. The subfamily is characterized here to make its diagnostic characters more widely understood. Similarly, the mandibulate genera of the nasute termites are excluded from Nasutitermitinae and a new subfamilial name is required to accommodate this group (proposed as Syntermitinae, below). Lastly, *Sphaerotermes* is excluded from the Macrotermitinae owing to a unique combination of plesiomorphic and apomorphic traits (see below).

Subfamily Foraminitermitinae Holmgren

Foraminitermitinae Holmgren, 1912: 5. Type genus: *Foraminitermes* Holmgren, 1912.

Combining stem: Foraminitermit–.

Diagnosis [Derived from Krishna and Adams (1982)]: **Imago.** Head densely pilose; fontanelle punctiform, situated at tip of a cornical projection. Forecoxa with longitudinal ridge, without protuberance; tibial spurs 3–2–2. **Soldier.** Left mandible with upper, inner cutting edge finely serrated, and with blunt teeth appearing as crenulations below serrations; right mandible smooth, without teeth, base of molar region with one or

TABLE 1

Hierarchical Outline of Termite Classification

All family-group names indicated; synonymic names italicized.

Order ISOPTERA Brullé, 1832
- Family Mastotermitidae Desneux, 1904a
- Family Kalotermitidae Froggatt, 1897
  - = *Glyptotermitinae Froggatt, 1897*
  - = †*Electrotermitinae Emerson, 1942*
- Family Hodotermitidae Desneux, 1904a
  - Subfamily †Carinatermitinae Krishna and Grimaldi, 2000
  - Subfamily †Lutetiatermitinae Schlüter, 1989
  - Subfamily Hodotermitinae Desneux, 1904a
- Family Termopsidae Holmgren, 1911[a]
  - Subfamily †Cretatermitinae Emerson, 1968
  - Subfamily Porotermitinae Emerson, 1942
  - Subfamily Stolotermitinae Holmgren, 1910a *[status: Engel and Krishna, in press]*[a]
  - Subfamily Termopsinae Holmgren, 1911
- Family Rhinotermitidae Froggatt, 1897
  - Subfamily †Archeorhinotermitinae Krishna and Grimaldi, 2003
  - Subfamily Coptotermitinae Holmgren, 1910a
    - = *Arrhinotermitinae Sjöstedt, 1926*
  - Subfamily Heterotermitinae Froggatt, 1897
    - = *Leucotermitinae Holmgren, 1910a*
  - Subfamily Prorhinotermitinae Quennedey and Deligne, 1975
  - Subfamily Psammotermitinae Holmgren, 1911
  - Subfamily Stylotermitinae Holmgren and Holmgren, 1917
  - Subfamily Termitogetoninae Holmgren, 1910a
  - Subfamily Rhinotermitinae Froggatt, 1897
- Family Serritermitidae Holmgren, 1910a
- Family Termitidae Latreille, 1802
  - Subfamily Apicotermitinae Grassé and Noirot, 1954 [1955]
    - = *Indotermitidae Roonwal and Sen Sarma in Roonwal, 1958*
  - Subfamily Foraminitermitinae Holmgren, 1912
  - Subfamily Sphaerotermitinae Engel and Krishna, new subfamily
  - Subfamily Macrotermitinae Kemner, 1934
    - = *Acanthotermitinae Sjöstedt, 1926 [see ICZN (2003) for priority]*
  - Subfamily Syntermitinae Engel and Krishna, new subfamily
  - Subfamily Nasutitermitinae Hare, 1937[a]
    - = *Eutermitinae Holmgren, 1910b [status: Engel and Krishna, in press]*[a]
  - Subfamily Termitinae Latreille, 1802
    - = *Microcerotermitinae Holmgren, 1910b*
    - = *Pseudomicrotermitinae Holmgren, 1912*
    - = *Amitermitinae Kemner, 1934*
    - = *Mirocapritermitinae Kemner, 1934*
    - = *Cubitermitini Weidner, 1956*
    - = *Mirotermitini Weidner, 1956*
    - = *Capritermitini Weidner, 1956*

† Fossil taxon.

[a] These names have problems of priority associated with them (e.g., Eutermitinae has priority over Nasutitermitinae; Stolotermitinae has priority over Termopsidae), and petitions for conservation of current usage have been made to the ICZN (Engel and Krishna, in press a & b). Present usage should be maintained until an authoritative opinion is rendered by the ICZN.

two very tiny, pointed, thornlike spines or projections. Labrum with hyaline tip. **Worker.** Gut with mixed segment absent; four malpighian tubules separately attached at transverse mesenteron-proctodeum junction, extending forward for short distance and then looping around toward hindgut; malpighian tubules swollen basally; first proctodeal segment (P_1) tubular and narrow proximally, almost same diameter as midgut, and dilated and saclike distally, with malpighian tubules forming jumbled mass (= pseudomalpighian knot of Noirot, 2001; Bitsch and Noirot, 2002).

INCLUDED GENERA: *Foraminitermes* Holmgren, 1912 and *Labritermes* Holmgren, 1914.

COMMENTS: This group was first recognized by Holmgren (1912), who had difficulty placing it with any other group of Termitinae (referring to it also as the "*Foraminitermes*-reihe") (also recognized as distinctive by other authors; e.g., Krishna, 1963; Krishna and Adams, 1982; Noirot, 2001). Noirot (2001) suggested that *Foraminitermes* belonged to a new subfamily, while a family-group name had already been proposed for it nearly a century ago.

SYNTERMITINAE, new subfamily

TYPE GENUS: *Syntermes* Holmgren, 1909 (*not* 1910a as cited by Snyder, 1949; Constantino, 1995, 1998; and other authors).

DIAGNOSIS: **Imago.** Fontanelle generally large, round; slightly depressed or forming a convex plate. Postclypeus moderately or strongly convex, with a median line. Fore- and hindwing with short R_1, sometimes R_2+R_3 joining costal margin very near the suture. Pronotum with anterior margins projecting laterally into points in *Syntermes*; in *Procornitermes*, *Cornitermes* and *Labiotermes* anterolateral corners without points, margins even. Arolium absent. **Soldier.** Nasus (frontal tube) well developed, tip flat; frontal pore wide and conspicuous; well-developed, functioning biting-mandibles; labrum simple, narrow, with hyaline tip. **Worker.** Gut with mixed segment doubled, dual lobes overlapping the first proctodeal segment (P_1) (except reduction to single in *Procornitermes*); enteric valve with spines in the inner scaly membrane (except reduced in *Syntermes*).

INCLUDED GENERA: *Syntermes* Holmgren, 1909; *Cornitermes* Wasmann, 1897; *Procornitermes* Emerson *In* Snyder, 1949; and *Labiotermes* Holmgren, 1912. Other mandibulate genera of Nasutitermitinae may eventually be included here as well.

SPHAEROTERMITINAE, new subfamily

TYPE GENUS: *Sphaerotermes* Holmgren, 1912.

DIAGNOSIS: **Imago.** Head with light, small, punctiform fontanelle. Labrum uniformly sclerotized, transparent; postclypeus with median line. **Soldier.** Head with sides rounded; inconspicuous fontanelle present in middle of head. Labrum with sides rounded, with hyaline point. Left mandible with a few serrations and blunt tooth near base; right mandible with inner cutting-edge smooth. Pronotum much narrower than head; anterior and lateral margins even, without projecting spines. **Worker.** Right mandible with 6–7 ridges on molar plate. Labrum uniformly sclerotized (Sands, 1998: lacking the transverse apical band of sclerotization seen in Macrotermitinae, e.g., Donovan et al., 2000); postclypeus strongly convex, with distinct median line. Gizzard with small pulvilli attached posteriorly on columns, crenulated crests of columns I and II poorly developed; setae of pulvilli poorly developed (Noirot, 2001). Conspicuous, backward-oriented bristles at the P_3-P_4 (paunch-colon) junction (Noirot, 2001) (unique among the Isoptera).

INCLUDED GENERA: Includes only *Sphaerotermes* Holmgren, 1912.

COMMENTS: This is a remarkable subfamily sister to the Macrotermitinae (e.g., three nymphal instars, unique worker instar, male workers larger than females) but unlike the macrotermitines, *Sphaerotermes* is not associated with *Termitomyces* fungi and lacks the transverse band of sclerotization across the labrum of the worker and the imago (Sands, 1998). While these are indeed plesiomorphies relative to Macrotermitinae, Sphaerotermitinae has some remarkable apomorphic traits that support its recognition [e.g., unique possession of conspicuous, backward-orient-

ed bristles at the P_3-P_4 (paunch-colon) junction: Noirot, 2001].

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